

JC10 Rec'd PCT/PTO 14 DEC 2001

10/018281

JORDAN AND HAMBURG LLP
122 East 42nd Street,
New York, NY 10168
Tel: (212) 986-2340 Fax: (212) 953-7733
Customer No.: 000028107

Docket No.: F-7251

Filing Date: December 14, 2001

Certificate of Express Mailing Under 37 CFR 1.10

"Express Mail" label number EL 486 304 679 US Date of Deposit 12/14/2001

I hereby certify that this correspondence is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to ASSISTANT COMMISSIONER OF PATENTS, WASHINGTON, DC 20231 having the above "Express Mail" label number on the date of deposit indicated above

Hannah Zun
(Typed or printed name of person mailing paper or fee)

Hannah K. Zun
(Signature of person mailing paper or fee)

THE ASSISTANT COMMISSIONER FOR PATENTS
Washington, D. C. 20231

- ☐ ATTN: BOX PATENT APPLICATION
☐ ATTN: BOX DESIGN PATENT APPLICATION
☒ ATTN: BOX PCT
☐ ATTN: BOX PROVISIONAL PATENT APPLICATION
☒ THIS IS THE 35 U.S.C 371 NATIONAL STAGE OF PCT/DE00/02010 FILED

June 14, 2000

Sir:

Transmitted herewith for filing is the ☒ Utility ☐ Design ☒ nonprovisional ☐ provisional
patent application of:

Inventor / Application Identifier: Reinhard MAUERMANN, et al.

☒ See Inventor Information Sheet attached

For: **METHOD, DEVICE AND AUXILIARY JOINING PART FOR EFFECTING A
MECHANICAL JOINING**

- ☐ This is a new patent application.
☒ This is the 35 U.S.C. 371 National Stage Application of the above-identified PCT Application.
☐ This is a provisional patent application.
☐ This is a: ☐ Continuation Application
☐ Divisional Application
☐ Continuation-in-Part Application
of prior Application Serial No. ____
☐ Cancel in this application original claims ____ of the prior application before
calculating the filing fee.
☐ Amend the specification by inserting before the first line the sentence:
-- This is a ☐ Continuation, ☐ Divisional, ☐ Continuation-in-part, of
Application

[] Incorporation By Reference. The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

ENCLOSED ARE THE FOLLOWING:		
X	3	Sheets of drawings ([X] formal [] informal size A4).
X	7	Pages of specification including abstract and claims.
X	10	Total pages.
Combined Declaration and Power of Attorney		
		Newly executed
		Copy from prior application
		Inventors deleted; see attached statement
Sequence Listing		
		Computer Readable Copy
		Paper copy
		Statement verifying identity of above copies
X	Return Receipt Postcard	
X	Preliminary Amendment	
Assignment to:		
		Assignment is of record in prior application Serial No. _.
		Assignment Recordation Form Cover Sheet.
		Charge \$40.00 to Deposit Account No. 10-1250 for recording Assignment.
X	Information Disclosure Statement	
X	Information Disclosure Citation	
	English translation	
X	Application Data Sheet	

PRIORITY CLAIMS	
	Applicant hereby claims the benefit of the filing date of the following provisional application(s) under the provision of 35 USC 119.
X	Applicant hereby claims the benefit under the provisions of 35 USC 119 of the filing dates of the following applications as indicated below: Germany Patent Appln. No. 199 27 103.8, filed June 14, 1999, Priority Claimed of which certified copies thereof
	will follow
	are enclosed
X	have been filed in the International Bureau
	were filed in prior application:

CLAIMS FILED AND FILING FEE CALCULATION					
ITEM	—			Rate	Applied Fee
[] Base Fee - Non PCT	—			\$740	
[] Base Fee - PCT IPEA-US	—			\$710	
[] Base Fee - PCT ISA-US	—			\$740	
[] Base Fee - PCT not ISA or IPEA	—			\$1,040	
[X] Base Fee - PCT with EPO or JPO Search Report	—			\$890	\$890
[] Base Fee - Design	—			\$330	
[] Base Fee - Provisional	—			\$160	
Claim Fees	Number Filed	Base Number	Number Extra over Base	—	
Total Claims	11	20	0	\$18	\$0
Independent Claims	3	3	0	\$84	\$0
Multiple Dependent Claim Fee	—			\$280	\$280
[.] Small Entity Status is Asserted	—				(\$0)
[] Foreign Language Filing Fee	—			\$130	\$0
TOTAL FILING FEE					\$1,170

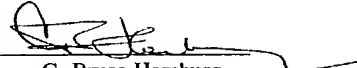
1107018281 1 061206

JC05 Rec'd PCT/PTO 1 4 DEC 2001

- [X] Please charge Deposit Account No. 10-1250 in the amount of the above TOTAL FILING FEE. A duplicate copy of this sheet is attached.
- [X] Please charge to Deposit Account No. 10-1250 any further fees due for filing or during prosecution of this application under: 37 CFR 1.16; 37 CFR 1.17; and 37 CFR 1.492.

JORDAN AND HAMBURG LLP

By


C. Bruce Hamburg
Reg. No. 22,389
Attorney for Applicant

INVENTOR INFORMATION SHEET

Docket Number: F-7251

Title: METHOD, DEVICE AND AUXILIARY JOINING PART FOR EFFECTING A
MECHANICAL JOINING

Filing Date: 12/14/2001

1. Full Name of Inventor Reinhard MAUERMANN	Family Name MAUERMANN	First Given Name Reinhard	Second Given Name
Citizenship Germany	Residence City Dresden	Residence State or Province	Residence Country Germany
Postal Address Pohlandstrasse 12	City Dresden	Province/State	Postal Code/Country D-01309 Germany
2. Full Name of Inventor Wolfgang VOELKNER	Family Name VOELKNER	First Given Name Wolfgang	Second Given Name
Citizenship Germany	Residence City Dresden	Residence State or Province	Residence Country Germany
Postal Address Georg-Palitzsch-Strasse 111	City Dresden	Province/State	Postal Code/Country D-01239 Germany
3. Full Name of Inventor Guenter BERGER	Family Name BERGER	First Given Name Guenter	Second Given Name
Citizenship Germany	Residence City Dresden	Residence State or Province	Residence Country Germany
Postal Address Kadenstrasse 14	City Dresden	Province/State	Postal Code/Country D-01237 Germany

F-7251

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Reinhard MAUERMANN et al.

Serial No. : (Not yet known) (U.S. National Stage of
PCT/DE00/02010 filed June 14, 2000)

Filed : Concurrently herewith

For : METHOD, DEVICE AND AUXILIARY JOINING
PART FOR EFFECTING A MECHANICAL
JOINING

Group Art Unit : (Not yet known)

Examiner : (Not yet known)

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Preliminary to examination, please amend the above-identified patent
application as follows:

IN THE SPECIFICATION:

Please replace indicated paragraphs of the specification with replacement
paragraphs presented below. Appendix II is attached hereto having marked
versions of said indicated paragraphs with amendments indicated by brackets and
underlining.

F-7251

Page 1: 1st full paragraph, replace with the following:

The invention relates to a method, a device and an auxiliary joining part for mechanical joining by means of punch riveting.

Page 1: 6th full paragraph, replace with the following:

For the C-frames preferably used as tool frames, heavy forces limit the capacity and hence, the applicability of the method.

Page 1: 9th full paragraph, replace with the following:

According to the invention, the problem is solved by a method in which, during the axial feeding motion of the semitubular rivet, the upper tool or/and a portion of the lower tool are given a wobbling additional movement in radial and/or tangential direction.

Page 2: 2nd full paragraph, replace with the following:

F-7251

Advantageously, for punch riveting with semitubular rivet a rivet is used the head of which has a convex elevation and the shank inner and outer contours of which beginning from the rivet foot in direction to the rivet head are shaped such that a continuous increase of the cross-sectional area of the rivet shank occurs.

Page 2: 4th full paragraph, replace with the following:

According to the invention, the problem is further solved by a device by means of which the upper tool or/and a portion of the lower tool as counterpunch can be moved in a wobbling manner in radial and/or tangential directions.

Page 2: 8th full paragraph, replace with the following:

According to the invention, the problem is further solved by an auxiliary joining part whereby the shank inner and outer contours, beginning from the rivet foot in direction of the rivet head, are shaped such that a continuous increase of the cross-sectional area of the rivet shank results.

Page 3: 1st full paragraph, delete the following:

F-7251

IN THE CLAIMS:

Please cancel claim 9 without prejudice and amend the claims as rewritten below. Appendix I is attached hereto having marked versions of said claims with amendments indicated by brackets and underlining.

1. (Amended) Method for mechanical joining of stacked plate-shaped objects comprising punch riveting with semitubular rivet using tools situated above and below the objects whereby the semitubular rivet penetrates linearly into the objects, wherein during axial feeding movement of the semitubular rivet the upper tool and/or a portion of the lower tool are given a wobbling additional movement in radial and/or tangential direction.

2. (Amended) Method of Claim 1 wherein the rivet has a head having a convex elevation and a shank having an inner contour and an outer contour which are shaped with a continuous increase of the cross-sectional area of the shank from a foot of the rivet to a head of the rivet.

3. (Amended) Method of Claim 1 or 2, wherein the wobbling additional movement comprises synchronized, simultaneous wobbling additional movement of the upper tool and a portion of the lower tool.

F-7251

4. (Amended) Method of Claim 1 or 2, wherein the wobbling additional movement is carried out with a wobbling angle of from 1° to 10° .

5. (Amended) Apparatus for mechanical joining of stacked plate-shaped objects by punch riveting with semitubular rivet whereby the semitubular rivet penetrates linearly into the object, comprising an upper tool, a lower tool, a die fixed in axial direction and a feeding device for the rivet, wherein the upper tool and/or a portion of the lower tool is supported to permit a wobbling movement in radial and/or tangential directions to be imparted thereto.

6. (Amended) Apparatus of Claim 5, wherein the die is a split die.

7. (Amended) Apparatus of Claim 5, wherein no portion of the lower tool is supported to permit wobbling motion to be imparted thereto and a portion of the lower tool and the die are integral.

8. (Amended) Semitubular rivet for use in a method for mechanical joining of stacked plate-shaped objects by punch riveting with the rivet using tools situated above and below the objects whereby the rivet penetrates linearly into the objects and wherein during axial feeding movement of the rivet the upper tool and/or a portion of the lower tool are given a wobbling additional movement in

F-7251

radial and/or tangential direction, the rivet comprising a head having a convex elevation and a shank having an inner contour and an outer contour which are shaped with a continuous increase of the cross-sectional area of the shank from a foot of the rivet to a head of the rivet.

10. (Amended) Semitubular rivet of Claim 8, wherein the inner contour and the outer contour each comprise a tractrix curve and wherein the starting points of the curves are located in direction of the rivet foot and the transfer of the curves in the center is shaped tangentially.

IN THE ABSTRACT:

Please replace the abstract with the substitute abstract submitted on the following separate page.

F-7251

ABSTRACT

The invention relates to a method for mechanically joining stacked, plate-shaped objects, especially metal sheets by means of punch riveting with a semitubular rivet while using tools placed above and below the objects, whereby the semitubular rivet linearly penetrates into the objects. The inventive method is characterized in that, during the axial feed motion of the semitubular rivet, the upper tool and/or a portion of the lower tool is/are subjected to a wobbling additional movement in a radial and/or tangential direction. The invention also relates to an apparatus and to the semitubular rivet which are used for carrying out the method.

F-7251

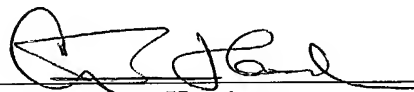
REMARKS

This Preliminary Amendment, which does not introduce new matter, amends the specification and claims consistently with the substance of an Article 34 Amendment filed in the International Stage, except with substantial adaptations being made for U.S. practice, corrects obvious errors and provides an Abstract more suitable for U.S. practice. The revised discussion of prior art included in the Article 34 Amendment is not included in this Preliminary Amendment as that might be considered new matter under U.S. practice.

Respectfully submitted,

Jordan and Hamburg LLP

By


C. Bruce Hamburg
Reg. No. 22,389
Attorney for Applicants

122 East 42nd Street
New York, New York 10168
(212) 986-2340

F-7251

APPENDIX I

AMENDED CLAIMS WITH AMENDMENTS INDICATED THEREIN BY BRACKETS AND UNDERLINING

1. (Amended) Method for mechanical joining of stacked plate-shaped [joining partners, particularly of sheets (4, 5) by means of] objects comprising punch riveting with semitubular rivet using tools situated above and [beneath of] below the [joining partners,] objects whereby the semitubular rivet penetrates linearly into the [joining partners characterized in that] objects, wherein during [the] axial feeding movement of the semitubular rivet the upper tool [(7) or/and] and/or a portion [(8)] of the lower tool are given a wobbling additional movement in radial and/or tangential direction.

2 (Amended) Method [to] of Claim 1 [characterized in that a semitubular rivet with material accumulations in critical areas (6a to 6e) is used] wherein the rivet has a head having a convex elevation and a shank having an inner contour and an outer contour which are shaped with a continuous increase of the cross-sectional area of the shank from a foot of the rivet to a head of the rivet.

3. (Amended) Method [to] of Claim 1 or 2 [characterized in that during the] , wherein the wobbling additional movement comprises synchronized,

F-7251

simultaneous wobbling additional movement of the upper tool [(7)] and a portion [(8)] of the lower tool [these carry out a synchronized movement].

4. (Amended) Method [to] of Claim 1 [to 3 characterized in that] or 2, wherein the wobbling additional movement is carried out with a wobbling angle [(10) between] of from 1° [and] to 10°.

5. (Amended) [Device for carrying out the method to any of the Claims 1 to 4, which consists of] Apparatus for mechanical joining of stacked plate-shaped objects by punch riveting with semitubular rivet whereby the semitubular rivet penetrates linearly into the object, comprising an upper tool [(7)], a lower tool [(8, 9)], a die [(9)] fixed in axial direction and a feeding device for the [auxiliary joining part characterized in that] rivet, wherein the upper tool [(7) or/and] and/or a portion [(8)] of the lower tool [is/are] is supported [such that they can be given] to permit a wobbling movement in radial and/or tangential directions to be imparted thereto.

6. (Amended) [Device to] Apparatus of Claim 5 [characterized in that] , wherein the die [(9)] is a split die.

F-7251

7. (Amended) [Device to] Apparatus of Claim 5 [characterized in that for a not wobbling portion (8) of the lower tool the single parts (8, 9) are constructed as one part] , wherein no portion of the lower tool is supported to permit wobbling motion to be imparted thereto and a portion of the lower tool and the die are integral.

8. (Amended) [Auxiliary joining part] Semitubular rivet for [carrying out the process to any of the Claims 1 to 4 designed as a semitubular rivet characterized in that the semitubular rivet has material accumulations in critical areas (6a to 6e)] for use in a method for mechanical joining of stacked plate-shaped objects by punch riveting with the rivet using tools situated above and below the objects whereby the rivet penetrates linearly into the objects and wherein during axial feeding movement of the rivet the upper tool and/or a portion of the lower tool are given a wobbling additional movement in radial and/or tangential direction, the rivet comprising a head having a convex elevation and a shank having an inner contour and an outer contour which are shaped with a continuous increase of the cross-sectional area of the shank from a foot of the rivet to a head of the rivet.

10. (Amended) [Auxiliar joining part to] Semitubular rivet of Claim 8 [or 9 characterized in that] , wherein the inner contour [(6d, 6e)] and the outer contour [(6b, 6c) of the semitubular rivet is described by] each comprise a tractrix [curves in each case, whereby] curve and wherein the starting points of the curves are

F-7251

located in direction of the rivet foot and the transfer of the curves in the [centre]

center is shaped tangentially.

F-7251

APPENDIX II**AMENDED SPECIFICATION PARAGRAPHS WITH AMENDMENTS
INDICATED THEREIN BY BRACKETS AND UNDERLINING**

Page 1: 1st full paragraph, replace with the following:

The invention relates to a method, a device and an auxiliary joining part for mechanical joining by means of punch riveting [according to the generic terms of Claims 1, 5 and 8].

Page 1: 6th full paragraph, replace with the following:

For the C-frames preferably used as tool frames, heavy forces limit the [daylight] capacity and hence, the applicability of the method.

Page 1: 9th full paragraph, replace with the following:

According to the invention, the problem is solved by a method [with the features mentioned in Claim 1] in which, during the axial feeding motion of the semitubular

F-7251

rivet, the upper tool or/and a portion of the lower tool are given a wobbling additional movement in radial and/or tangential direction.

Page 2: 2nd full paragraph, replace with the following:

Advantageously, for punch riveting with semitubular rivet [rivets are] a rivet is used [with material accumulated in critical areas] the head of which has a convex elevation and the shank inner and outer contours of which beginning from the rivet foot in direction to the rivet head are shaped such that a continuous increase of the cross-sectional area of the rivet shank occurs.

Page 2: 4th full paragraph, replace with the following:

According to the invention, the problem is further solved by a device [in connection with the features mentioned in the generic term of Claim 5 whereby] by means of which the upper tool or/and a portion of the lower tool as counterpunch can be moved in a wobbling manner in radial and/or tangential directions.

Page 2: 8th full paragraph, replace with the following:

F-7251

According to the invention, the problem is further solved by an auxiliary joining part [in connection with the features mentioned in the generic term of Claim 8] whereby the [semitubular rivet is provided with material accumulations in critical areas] shank inner and outer contours, beginning from the rivet foot in direction of the rivet head, are shaped such that a continuous increase of the cross-sectional area of the rivet shank results.

Page 3: 1st full paragraph, delete the following:

[Advantageously, the rivet has a convex elevation at the rivet head.]

3/PRTS

10018281 10/018281

JCO5 Rec'd PCT/PTO 1 4 DEC 2001

Method, device and auxiliary joining part for effecting a mechanical joining

The invention relates to a method, a device and an auxiliary joining part for mechanical joining by means of punch riveting according to the generic terms of Claims 1, 5 and 8.

In known punch riveting with semitubular rivets the auxiliary joining part (the rivet) is joined into the sheets to be joined by a linear movement without a prepunched hole.

In known clinching a punch penetrates during the working stroke in a linear motion into the sheets to be joined, whereby on the opposite side a solid or split die takes part in forming the die side of the clinch spot. A counterpunch is positioned in the split die.

The known wobbling movement is used for the forming of a rivet head on the face side by partial compressive deformation.

This movement is also used in clinching, i.e. joining without using an auxiliary joining part (DE 198 43 874.5).

In known punch riveting heavy forces are required during the linear punch motion. Therefore the tool load is high which limits the application for high-strength sheet materials.

For the C-frames preferably used as tool frames, heavy forces limit the daylight and hence, the applicability of the method.

Due to the flow of the sheet material and the additional deformation of the auxiliary joining part, a specific shape of the joint results during the linear punch movement.

It is the objective of this invention to reduce the forces occurring in punch riveting. This aims at extending the field of application of this process concerning high-strength materials and the accessibility of C-frames for large workpieces. It is another objective of this invention to eliminate the process's weak points of drawing-in of the head and low expansion and thus to achieve a better appearance and higher joining strengths in equivalent joining jobs.

According to the invention, the problem is solved by a method with the features mentioned in Claim 1 in which, during the axial feeding motion of the semitubular rivet, the upper tool or/and a portion of the lower tool are given a wobbling additional movement in radial and/or tangential direction.

This additional movement is superimposed on the axial feeding motion during the whole or part of the joining process. The wobbling movement can take place tangentially, e.g. in a circular motion, radially outwards from the centre, e.g. in a pivoting motion, and in a combined motion tangentially/radially, e.g. in a rosette kinematics. Due to the wobbling movement the material is partially deformed which distinctly reduces the process forces.

Advantageously, for punch riveting with semitubular rivet rivets are used with material accumulated in critical areas.

It is also advantageous, for a simultaneous active additional movement of the upper tool and a portion of the lower tool, to make these move synchronously such that the introduced axial forces of the punches oppose each other directly.

According to the invention, the problem is further solved by a device in connection with the features mentioned in the generic term of Claim 5 whereby the upper tool or/and a portion of the lower tool as counterpunch can be moved in a wobbling manner in radial and/or tangential directions.

In the device according to the invention, at least one of the tools (upper tool, a portion of the lower tool as counterpunch) is displaced in a wobbling manner in addition to the known axial feed motion. Both opposing tools can execute this wobbling motion simultaneously and, in a special embodiment, synchronizedly.

Advantageously, the die of the device is a split die. This allows to realize a special material flow on the die side of the joint.

In an embodiment of the device with only the upper tool wobbling, the lower tool, which in other cases is split, is designed as a one-piece part.

According to the invention, the problem is further solved by an auxiliary joining part in connection with the features mentioned in the generic term of Claim 8 whereby the semitubular rivet is provided with material accumulations in critical areas.

Advantageously, the rivet has a convex elevation at the rivet head.

It is also advantageous that the inner and outer profiles of the semitubular rivet are described by two tractrix curves in each case whereby the start points of the curves are situated in direction of the rivet foot and rivet head, respectively, and the transition of the curves is tangential in the centre.

In the following, the invention is further explained by examples of embodiment. In the drawings it is shown by

- Fig. 1 a representation of state-of-the-art punch riveting;
- Fig. 2 a semitubular rivet according to the invention;
- Fig. 3 a representation of punch riveting with superimposed wobbling movement.

In Fig. 1 the known punch riveting with punch 1 and fixed die 2 is represented. The standard semitubular rivet 3 penetrates in an axial movement into the sheets to be joined 4 and 5. This rivet usually has a flat head 3a, a radius 3b and a chamfer 3c.

In Fig. 2 a semitubular rivet 6 adapted to the wobbling movement is shown. It has a material accumulation in form of a convex elevation at the rivet head 6a. Therefore the introduced force is concentrated mainly on the area of the rivet head centre in the first period of the process, wherefrom the cutting forces to cut the upper sheet are passed to the rivet foot. The periphery of the rivet head is plastified only at the end of the joining process, when the entire rivet head is formed flat. The additional rivet material of the convex elevation is displaced radially outwards during flat forming. With the resulting increase of the rivet head diameter the drawing-in zone 12 in the upper sheet is reduced.

Further the contours of the semitubular rivet 6 are described by two tractrix curves each.

The start points of the tractrix outer contour are situated at the rivet foot (curve 6c) and rivet head (curve 6b). The start points of the tractrix inner contour are also at the rivet foot (curve 6e) and at the upper point of the inner contour (curve 6d).

The inner curves 6d and 6e and the outer curves 6b and 6c are connected to each other by a tangential transition. This aims at increasing the cross-sectional area of the rivet, which is an annular area in the lower portion and a circular area in the upper portion, continuously beginning from the rivet foot. Therefore, in every cross-section, the bending moment which in-

creases beginning from the rivet foot during joining can be taken into account and no weak points develop at chamfer or radius, respectively, transition points. Owing to this design of the auxiliary joining part the loads developing during partial deformation can be absorbed in an improved way and the undesired compression of the rivet foot can be reduced. A better expansion develops and hence a higher strength of the joint.

In Fig. 3 the riveting process with superimposed wobbling movement 11 is shown in its final phase. As a wobbling movement 11 a movement is superimposed that describes a rosette or a circle. The synchronizedly wobbling tools, upper tool 7 – punch – and lower tool 8 – here the counterpunch as portion of the lower tool – swivel at a maximum wobbling angle 10 whereby this angle is between 1° and 10° , preferably 3° .

Nomenclature

- 1 — punch
- 2 — fixed die
- 3 — standard semitubular rivet
- 3a — flat head
- 3b — radius
- 3c — chamfer
- 4 — punch-side sheet
- 5 — die-side sheet
- 6 — semitubular rivet
- 6a — convex elevation at the rivet head
- 6b — upper smaller tractrix curve at the outer contour
- 6c — lower bigger tractrix curve at the outer contour
- 6d — upper smaller tractrix curve at the inner contour
- 6e — lower bigger tractrix curve at the inner contour
- 7 — upper tool
- 8 — portion of the lower tool
- 9 — split die with inner cone
- 10 — wobbling angle
- 11 — wobbling movement
- 12 — drawing-in

Claims

1. Method for mechanical joining of stacked plate-shaped joining partners, particularly of sheets (4, 5) by means of punch riveting with semitubular rivet using tools situated above and beneath of the joining partners, whereby the semitubular rivet penetrates linearly into the joining partners **characterized in that** during the axial feeding movement of the semitubular rivet the upper tool (7) or/and a portion (8) of the lower tool are given a wobbling additional movement in radial and/or tangential direction.
2. Method to Claim 1 **characterized in that** a semitubular rivet with material accumulations in critical areas (6a to 6e) is used.
3. Method to Claim 1 or 2 **characterized in that** during the simultaneous wobbling additional movement of the upper tool (7) and a portion (8) of the lower tool these carry out a synchronized movement.
4. Method to Claim 1 to 3 **characterized in that** the wobbling additional movement is carried out with a wobbling angle (10) between 1° and 10°.
5. Device for carrying out the method to any of the Claims 1 to 4, which consists of an upper tool (7), a lower tool (8, 9), a die (9) fixed in axial direction and a feeding device for the auxiliary joining part **characterized in that** the upper tool (7) or/and a portion (8) of the lower tool is/are supported such that they can be given a wobbling movement in radial and/or tangential directions.
6. Device to Claim 5 **characterized in that** the die (9) is a split die.
7. Device to Claim 5 **characterized in that** for a not wobbling portion (8) of the lower tool the single parts (8, 9) are constructed as one part.
8. Auxiliar joining part for carrying out the process to any of the Claims 1 to 4 designed as a semitubular rivet **characterized in that** the semitubular rivet has material accumulations in critical areas (6a to 6e).

9. Auxiliar joining part to Claim 8 **characterized in that** the semitubular rivet has a material accumulation shaped as a convex elevation on the rivet head (6a).
10. Auxiliar joining part to Claim 8 or 9 **characterized in that** the inner contour (6d, 6e) and outer contour (6b, 6c) of the semitubular rivet is described by tractrix curves in each case, whereby the starting points of the curves are located in direction of the rivet foot and the transfer of the curves in the centre is shaped tangentially.

With 3 sheets of drawings.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro



(43) Internationales Veröffentlichungsdatum
21. Dezember 2000 (21.12.2000)

PCT

(10) Internationale Veröffentlichungsnummer
WO 00/76688 A1

(51) Internationale Patentklassifikation⁷: **B21J 15/02,**
15/12

[DE/DE]; Dezernat 5, SG 5.1, Mommsenstrasse 13,
D-01069 Dresden (DE).

(21) Internationales Aktenzeichen: PCT/DE00/02010

(72) Erfinder; und

(22) Internationales Anmeldedatum:
14. Juni 2000 (14.06.2000)

(75) Erfinder/Anmelder (nur für US): **MAUERMANN,**
Reinhard [DE/DE]; Pohlandstrasse 12, D-01309 Dresden
(DE). **VOELKNER, Wolfgang** [DE/DE]; Georg-Pal-
itzsch-Strasse 111, D-01239 Dresden (DE). **BERGER,**
Günter [DE/DE]; Kadenstrasse 14, D-01237 Dresden
(DE).

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
199 27 103.8 14. Juni 1999 (14.06.1999) DE

(74) Gemeinsamer Vertreter: **TECHNISCHE UNIVER-**
SITÄT DRESDEN; Sender, Frank, Dezernat 5, SG 5.1,
D-01062 Dresden (DE).

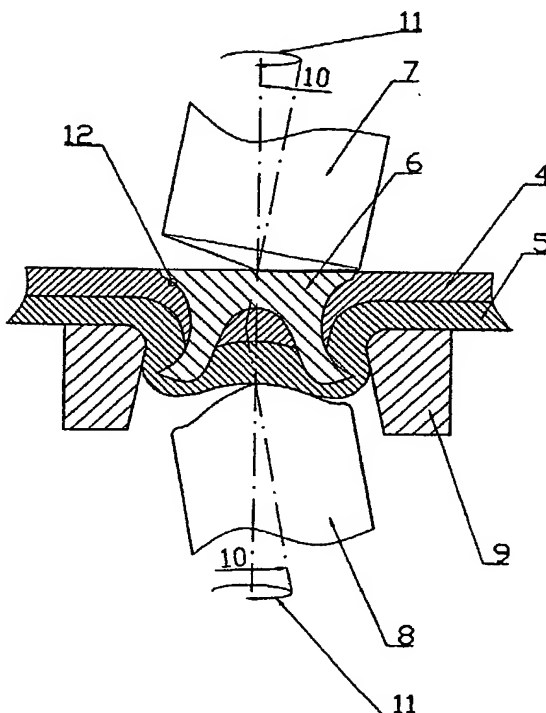
(71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme
von US): **TECHNISCHE UNIVERSITÄT DRESDEN**

(81) Bestimmungsstaaten (national): AE, AG, AL, AM, AT,
AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ,

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD, DEVICE AND AUXILIARY JOINING PART FOR EFFECTING A MECHANICAL JOINING

(54) Bezeichnung: VERFAHREN, VORRICHTUNG SOWIE HILFSFÜGETEIL ZUM MECHANISCHEN FÜGEN



(57) Abstract: The invention relates to a method for mechanically joining stacked, plate-shaped joining partners, especially metal sheets (4, 5) by means of punch riveting with a semitubular rivet while using tools placed above and below the joining partners, whereby the semitubular rivet linearly penetrates into the joining partners. The inventive method is characterized in that, during the axial feed motion of the semitubular rivet, the upper tool (7) and/or a portion (8) of the lower tool is/are subjected to a wobbling additional movement in a radial and/or tangential direction. The invention also relates to a device and to an auxiliary joining part which are used for carrying out said method.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren zum mechanischen Fügen von übereinander angeordneten plattenförmigen Fügepartnern, insbesondere von Blechen (4, 5), mittels Stanznieten mit Halbhohlmet (16), unter Einsatz von oberhalb und unterhalb der Fügepartner (4, 5) vorgesehenen Werkzeugen (7, 8), wobei der Halbhohlmet (16) geradlinig in die Fügepartner (4, 5) eindringt, dadurch gekennzeichnet, dass während der axialen Vorschubbewegung des Halbhohlmetes Ober-(7) oder/und ein Teil (8) des Unterwerkzeuges mit einer taumelnden Zusatzbewegung in radialer und/oder tangentialer Richtung beaufschlagt wird/werden. Eine Vorrichtung und ein Hilfsfügeteil (6) zur Durchführung des Verfahrens sind beschrieben.

WO 00/76688 A1

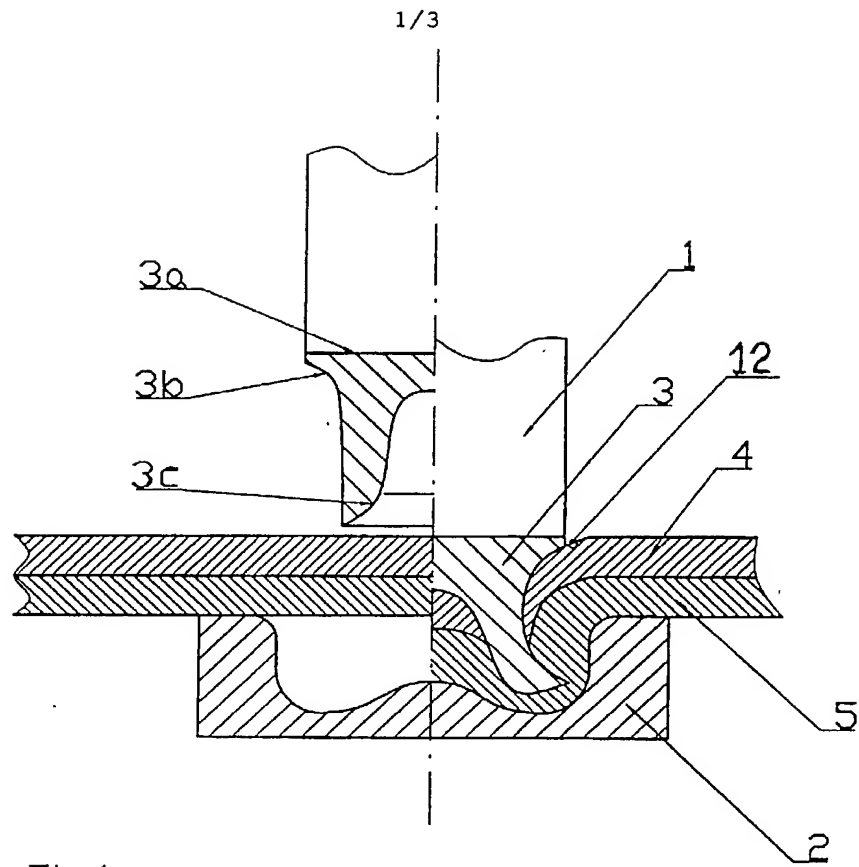


Fig.1

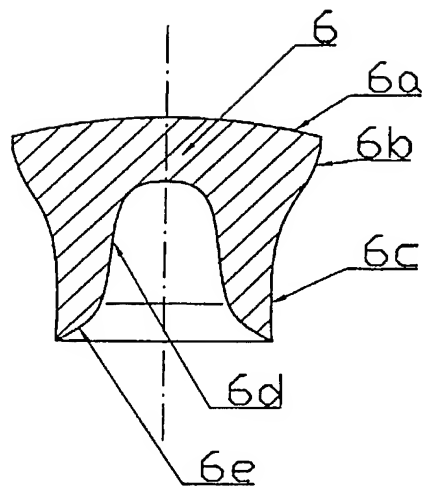


Fig.2

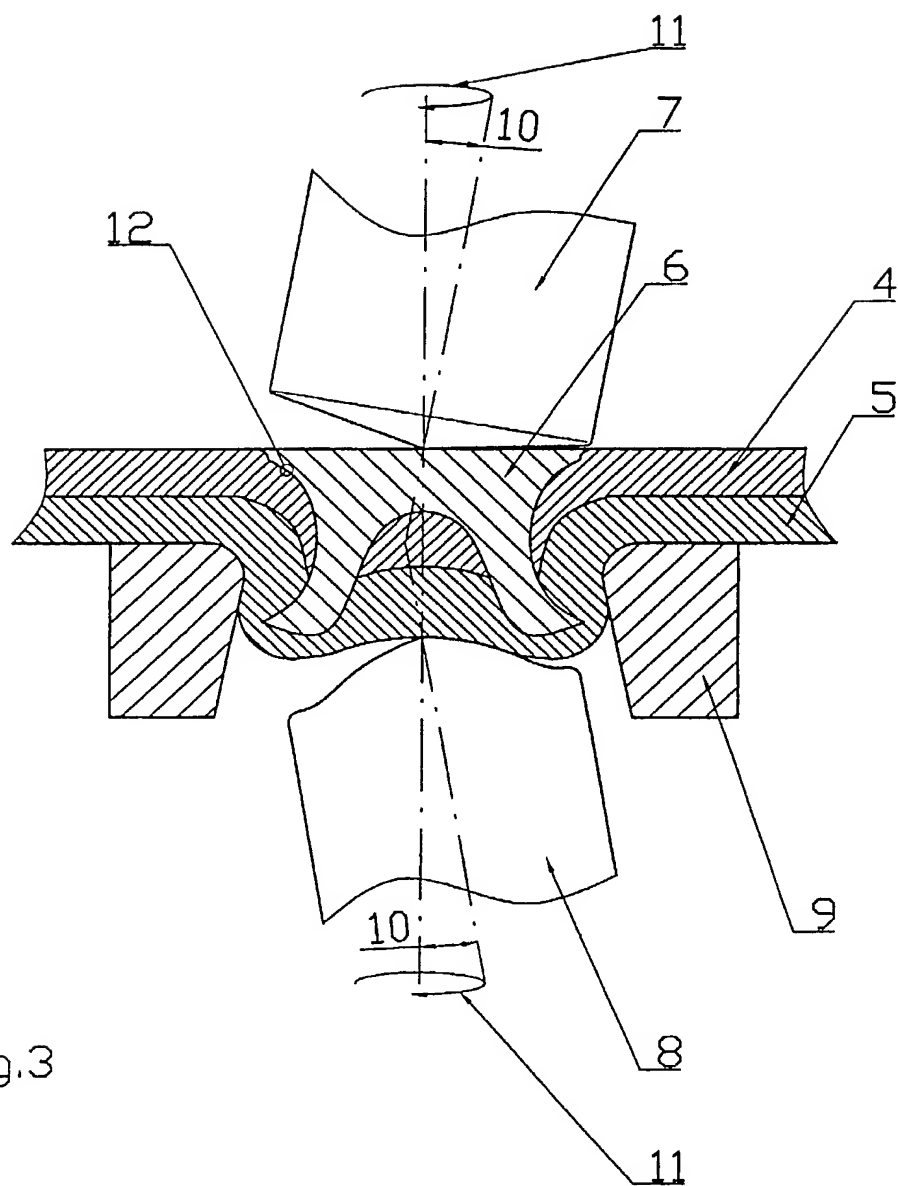


Fig.3

**COMBINED DECLARATION FOR PATENT APPLICATION AND
POWER OF ATTORNEY**

(includes Reference to PCT International Applications)

 Attorney's Docket Number
F-7251

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD, DEVICE AND AUXILIARY JOINING PART FOR EFFECTING A MECHANICAL JOINING

the specification of which (check only one item below):

- ☐ is attached hereto.
- ☐ was filed as United States application
Serial No. _____
and was amended
on _____ (if applicable).
- ☒ was filed as PCT international application
Number PCT/DE00/02010
on June 14, 2000
and was amended under PCT Article 19
on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or (f), §365(b) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:			
Country (if PCT indicate "PCT")	Application Number	Date of Filing	Priority Claimed Under 35 USC 119
Germany	199 27 103.8	June 14, 1999	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

**COMBINED DECLARATION FOR PATENT APPLICATION AND
POWER OF ATTORNEY (Continued)**
(Excluded Subjective to PCT International Applications)

Attorney's Docket Number
F-7251

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

C. Bruce Hamburg	Reg. No. <u>22,389</u>
Frank J. Jordan	Reg. No. <u>20,456</u>
Herbert F. Ruschmann	Reg. No. <u>35,341</u>
Jacqueline M. Steady	Reg. No. <u>44,554</u>
Marvin Turken	Reg. No. <u>18,350</u>
Alfred D'Andrea	Reg. No. <u>27,752</u>
Lawrence I. Wechsler	Reg. No. <u>36,049</u>

Send Correspondence To:

Jordan and Hamburg LLP
122 East 42nd Street
New York, New York 10168

Direct Telephone Calls to:
C. Bruce Hamburg
(212) 986-2340

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1-00

Full Name of First or sole Inventor	Inventor's Signature	Date
Reinhard MAUERMANN	<i>Reinhard Mauermann</i>	31.5.2002
Residence	Citizenship	
Dresden, Germany	Germany	
Post Office Address		
Pohlndstrasse 12, D-01309 Dresden, Germany		

DEX

2-00

Full Name of Second Inventor	Inventor's Signature	Date
Wolfgang VOELKNER	<i>Wolfgang Voelkner</i>	31.05.2002
Residence	Citizenship	
Dresden, Germany	Germany	
Post Office Address		
Georg-Palitzsch-Strasse 111, D-01239 Dresden, Germany		

DEX

3-00

Full Name of Third Inventor	Inventor's Signature	Date
Guenter BERGER	Guenter Berger	11.06.2002
Residence		Citizenship
Dresden, Germany	DEX	Germany
Post Office Address		
Kadenstrasse 14, D-01237 Dresden, Germany		